



How Financial Mathematics Focuses On Business And Others Mathematical Discipline?

Md. Enamul Kabir¹ & Mohammad Al -Amin²

¹Lecturer Department Of Business Administration, Z. H. Sikder University Of Science & Technology

²Lecturer (Mathematics) Department of Business Administration, Z.H. Sikder University of Science & Technology

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ABSTRACT: Simply, Finance is the science of Fund's Management. It includes saving money and often includes lending money. Financial mathematics, also known as quantitative finance, is a field of applied mathematics, concerned with financial markets. Generally, mathematical finance will derive and extend the mathematical or numerical models without necessarily establishing a link to financial theory, taking observed market prices as input. Mathematical consistency is required, not compatibility with economic theory. Thus, for example, while a financial economist might study the structural reasons why a company may have a certain share price, a financial mathematician may take the share price as a given, and attempt to use stochastic calculus to obtain the corresponding value of derivatives of the stock. The fundamental theorem of arbitrage-free pricing is one of the key theorems in mathematical finance. Mathematical finance also overlaps heavily with the fields of computational finance and financial derivatives & engineering. The goal of derivatives pricing is to determine the fair price of a given security in terms of more liquid securities whose price is determined by the law of supply and demand. The meaning of "fair" depends, of course, on whether one considers buying or selling the security. Examples of securities being priced are plain vanilla and exotic options, convertible bonds, etc.

Keywords: Finance concept, structure, personal finance, corporate finance, financial market & institution, time value of money, break-even analysis, objectives & future.

Literature Review:

A random and normative analysis is systematic process that can be observed in many fields. And this observation has many random positions over a period of time lays the foundation of stochastic processes (also called random process) because the random variable changes in an uncertain way.

I. INTRODUCTION

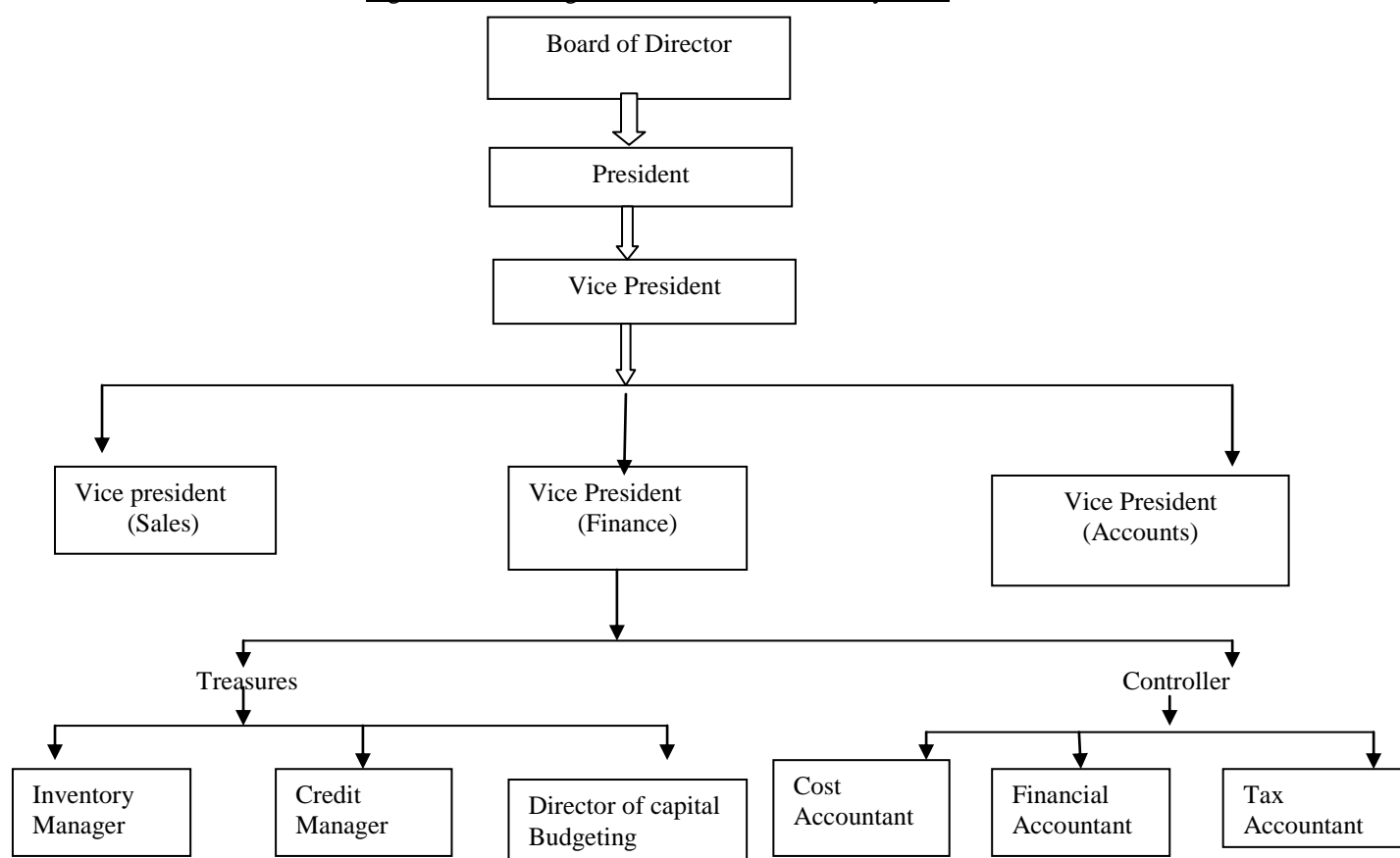
Finance is a field that deals with the study of investments time, money & energy. It includes the dynamics of assets and liabilities over time under conditions of different degrees of uncertainty and risk by the support of working management policy. Also it can also be defined as the science of money management. Finance aims to price assets based on their risk level and their expected rate of return. Finance can be broken into three different sub-categories: public finance, corporate finance and finance. Finance has revolutionized the way we think about investments cannot be denied. And its intellectual appeal may lie in its cross-disciplinary nature.

The general areas of Finance are,

- ✓ Business Finance
- ✓ Personal Finance
- ✓ Public Finance

The field of Finance deals with the concept of time, money, and risk, and how they are interrelated. Finance works most basically through individuals and Business Organizations depositing money in a bank. The bank then lends the money out to other individuals or corporation for consumption or investment and charge interest on the loan.

Figure: 1 Exhibiting the financial structure of any Firm.



Objectives of personal Finance:

Personal Finance revolves around;

- 1) How much money will be needed by an individual (or by a family) and when?
- 2) Where will this money come from and how?
- 3) How can people protect themselves against unforeseen personal events, as well as those in the external economy?
- 4) How can family assets best be transferred across generations (Inheritance)?
- 5) How does Tax policy (Tax subsidies or Penalties) affect personal financial decisions?
- 6) How does credit affects an individuals financial standing?
- 7) How can one plan for a secure financial future in an environment of economic instability?

Corporate Finance/ Managerial Finance revolve by managerial or corporate finance is the task of providing the funds for corporation’s activities. For example, some small business, SME finances. It generally involves balancing the risk and profitability, while attempting to maximize and entities, wealth and the value of its stock.

In investment management in choosing a portfolio (Bundle of securities), one has to decide what, how much and when to invest. To do this a company must,

- 1) Identify relevant objectives and constraints institutions and individual goals, time horizon risk and Tax consideration.
- 2) Identify the appropriate strategy active vs passive hedging strategy.
- 3) Measure the portfolio performance.

Financial Market & Institutions:

Financial Market- It is a mechanism or process by which Borrowers and Lenders get together.
Money Market- The financial markets in which funds are borrowed or loaned for short periods. (Generally 1 year or less.)

Capital Market: The financial Markets for stocks and long term debt.(Generally longer than 1 year.)

Primary Market: The Financial Market in which corporation's raises funds by issuing securities.

OTC (Over The Counter) Market: A large collections of Brokers and Dealers connected Electronically by Telephones and Computers that provides for trading in securities not listed on the organized exchange.

Organized Security Exchange: Formal organizations with physical locations where auction markets are conducted in designated (listed) securities. The two major US Stock Exchange are the New York Stock Exchange (NYSE) and the American Stock Exchange (AMEX).

Social Responsibility: The concept that Business should be actively concerned with the welfare of society at large. As example, DBBL, Grameen Phone, Protom Alo, etc.

Agency Problem- A potential conflict of interest between,

- (1) The principle (Outside Shareholders) and the agent (Manager) and,
- (2) Stockholders and Creditors (Debt holders.)

Business Ethics – The word Ethics is defined in Webster's Dictionary as "Standard of conduct or moral behavior". Business Ethics can be thought of as a company attitude and conduct toward its employes, customers, community and stockholders. High standers of Ethical behavior demand that, a firm treat each party it deals with in a fare and honest manner.

II. MATHEMATICAL PROBLEM

1. Cost of trade credit:

Problem # 1 What is the cost of trade credit for the following term 2/10 net 20 ?

Solutions:

Given,

Credit term = 2/10 net 20

Requirements= Cost of trade credit?

We know,

Cost of trade Credit = $D/100-D \times 360/MP-DP$

Where,

D=Discount Rate = 2 percent.

DP= Discount Period = 10 years.

MP=Maturity Period = 20 Days.

Now,

$$\begin{aligned} \text{Cost of credit} &= 2/100-2 \times 360/20-10 \\ &= 2/98 \times 360/10 \\ &= 0.7347 \\ &= 73.47\% \text{ Ans.} \end{aligned}$$

2. Short term Financing:

Problem # 2

A company credit sale is TK 20, 000, 00 and average collection period is 72 days. A factor is ready to pay advance factoring the company's receivable at 12% interest rate up to 80% of the Face value of receivable. The factor charges 2% commission. Compute,

- (1) Amount the company will get at Advance?
- (2) The total cost and,
- (3) Effective interest rate of factoring A/R (Accounts Receivable)? (1 USD = BDT 80)

Solution:

- (1) Average collection period = 72 days.
 Therefore accounts receivable = 360 days/ 72 days = 5 times.
 Average = Tk 20, 000,00 / 5 times = Tk 400,000.

Calculation of net amount as Advance	
Face Value of A/R	Tk 400,000
Less- 20% margin = 400,000 x 0.20 = 80,000	
Less- Factoring Commission = 400,000 x 0.02 = 8,000	
Less- Interest = (400,000 – 80,000 – 8,000)	Tk 95,488
= 3,12,000x0.12 x72 days / 360 days	
= Tk7488	Tk 3,04,512

Net amount of Advance = Tk 3, 04,512 Ans.

(2) Calculation of Total Cost,

Annual Commission = Tk 8000 x 5 times = Tk 40,000

Annual Interest = Tk 7488 x 5 times = Tk 37,440

Total Cost = Tk 77,440 Ans.

(3) Effective Interest Rate (EIR)

= Total annual factoring cost / Net amount of Advance x 100

= 77,440 / 3, 04,512 x 100

= 25.43 % Ans.

3. The Time Value of Money

Problem # 3 You have a plan to buy a car after 6 year from now. The car will cost Tk 400,000 at that time. You are planning to accumulate the required fund by a monthly deposit in a bank account bearing 12% interest. What would be the monthly installment of your deposit?

Solution:

Given,

Future Value (FV) = Tk 400,000

Rate of Interest (R) = 0.12/ 12 = 0.01

Number of Installment (N)= 6x12 = 72

Requirement, Monthly Installment = ?

We know,

$$FV= A [(1+R)^n - 1 / R]$$

$$\text{Or, } 400,000 = A [(1+0.01)^{72} - 1 / 0.01]$$

$$\text{Or, } 400,000 = A [104.7099]$$

$$\text{Or, } A (104.7099) = 400,000$$

$$\text{Or, } A = 400,000 / 104.7099$$

$$A= \text{Tk } 3820.08 \text{ (App)}$$

Break Even Point

What is break-even point? In economy, break-even point is when you don't make a profit and you don't lose money either in other words, your revenue is equal to your expenses. In economics and business, specifically cost accounting, the break-even point (BEP) is the point at which cost or expenses and revenue are equal: there is no net loss or gain, and one has "broken even." A profit or a loss has not been made, although opportunity costs have been "paid," and capital has received the risk-adjusted, expected return. It is shown graphically as the point where the total revenue and total cost curves meet. In the linear case the break-even point is equal to the fixed costs divided by the contribution margin per unit. The break-even point is achieved when the generated profits match the total costs accumulated till the date of profit generation. Establishing the break-even point helps businesses in setting plans for the levels of production which it needs to maintain be profitable.

Say R = revenue and C = cost

$$R = C$$

Calculate breakeven point using a formula

A breakeven point formula can be derived and you can just use the formula to calculate the breakeven point quicker

$$C = \text{fixed cost} + \text{variable cost}$$

Let x be the number of items sold and let c (lower case c) be the fee charged for each item sold

variable cost = fee charged for each item sold \times number of items sold

$$\text{variable cost} = c \times x$$

$$C = \text{fixed cost} + cx$$

Let s be selling price of one item

$$R = s \times x$$

$$R = C$$

$$sx = \text{fixed cost} + cx$$

$$sx - cx = \text{fixed cost} + cx - cx$$

$$sx - cx = \text{fixed cost}$$

$$x(s - c) = \text{fixed cost}$$

Divide both sides of the equation by $s - c$

$$x = \text{fixed cost} / s - c$$

In example 2, fixed cost = \$75, $s = \$1.50$, and $c = \$1$. To calculate break-even point, just put these numbers into the formula

$$x = 75 / 1.50 - 1$$

$$x = 75 / 0.50$$

$$= 150 \text{ (App.)}$$

Problem # 4

It costs a publishing company 50,000 dollars to make books. The 50,000 is a fixed cost or a cost that cannot change. To help the publishing company sell the books, a marketing company charges 4 dollars for each book sold. If the company charges 9 dollars per book, how many books should they sell to break even?

Solution :

Let x be the number of books sold

Let C be the cost of producing and selling x books

Let R be the revenue made for selling x books

R = selling price of 1 book \times number of books sold

$$R = 9x$$

C = fixed cost + variable cost

variable cost = fee charged for 1 book \times number of books sold

$$\text{variable cost} = 4x$$

$$C = 50000 + 4x$$

$$R = C$$

$$9x = 50000 + 4x$$

$$9x - 4x = 50000 + 4x - 4x$$

$$5x = 50000$$

$$x = 10000 \text{ since } 5 \times 10000 = 50000$$

Therefore, The breakeven point is to sell 10000 books.

Problem # 5

It costs a man 75 dollars to buy the things that he needs to make Pizza. The city allows him to sell his pizza somewhere near the city hall. However, the city hall charges him 1 dollar for each Pizza sold .Calculate the breakeven point if the price he charges for 1 Pizza is \$1.50.

Solution :

Let x be the number of Pizza sold

Let C be the cost of buying and selling x Pizza

Let R be the revenue made for selling x Pizza

R = selling price of 1 Pizza \times number of Pizza sold

$$R = 1.50x$$

C = fixed cost + variable cost

variable cost = fee charged for 1 Pizza \times number of Pizzas sold

variable cost = 1x

$$C = 75 + 1x$$

$$R = C$$

$$1.50x = 75 + 1x$$

$$1.50x - 1x = 75 + 1x - 1x$$

$$0.5x = 75$$

$$x = 150 \text{ since } 0.5 \times 150 = 75$$

The breakeven point is to sell 150 Pizza.

III. Methodology

Here we introduced the major numerical & theoretical methods that needed for quantitative work in finance & mathematics. To this avail, we study a balance between a general survey of significant numerical methods anyone working in a quantitative should know, and a detailed study of some numerical methods specific to financial mathematics. In the first part of this study will cover e.g.

Financial and non-financial problem, option pricing, hedging and optimization,

While the second part introduces breakeven analysis, finite difference method, and different cost analysis

The assessment consists of 85% an exam and 15% a project.

IV. Findings

Financial mathematics is the application of mathematical methods to the solution of problems in finance. A large part of this study is the ability to create testable hypotheses based on a fundamental understanding of the objects of analysis and prove or contradict the hypotheses through repeatable studies. In this light, mathematics is the language for representing theories and provides tools for testing their validity.

Ultimate objectives of mathematical finance:

By appropriate (**Normative**) analysis, we suggesting our readers and peoples for rewarding careers in investment banks, hedge funds, asset management companies, financial software and data companies, and insurance companies, with roles in financial modeling and software development model, market, credit, and operational risk management, asset valuation, trading desk support, trading, investment analysis & portfolio management.

Future of Mathematical finance:

All in all, a number of developments are underway or will be required, regarding both practices and training. Trainers are encouraged to put particular emphasis on statistics and to get students to work on a vision of global quantitative risk. This is now a central aspect. Some teachings have been reinforced: regulation, market risk.

*Corresponding Author: Md. Enamul Kabir¹ & Mohammad Al- Amin²

V. Conclusion

The range of the considered disciplines raises another problem. Indeed, a few months of training are barely enough for the student – even the most brilliant – to assimilate all of stochastic calculus, finance, statistics & law. The quantitative view of finance will not set the pace, although in some sectors (asset management, finance) some dream of going back to the old-style, less sophisticated way of doing things. The models are structurally imperfect. At best, they simplify the reality; but a model is wrong by definition. One important challenge is to clarify the use that can be made of them. Basically, the issue is to use them while knowing that they are false and, if possible, understand their limits. A problem in this respect is that the regulator fixes a number of positions, instead letting them evolve. It's dangerous to think that defining a standard requires a consensus. But then, it is important to explore the areas where we can't explain everything. Another problem: during the crisis, much attention was paid to economists, when these are disconnected from the technological realities (high-frequency trading, new software...). The same goes for regulators and policy makers. There is therefore a danger of creating a regulation completely disconnected from market reality. I strongly believe in the necessity of a dialogue between the various players and the different disciplines involved. Finally, what it ought to do into business world and as normative financial mathematics analyst; we considering the optimal application that can ensure the business & mathematical value appropriately.

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Author's Declaration

The Author hereby declared that, this is the original research work and not to publish before or submitted for publication in any other journals. The approach used here is totally new and initiative in the context of recent trend of the business world.